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COTTON PRODUCTION IN NORTHEAST BRAZIL

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COTTON PRODUCTION IN NORTHEAST BRAZIL ^{1/}

By P. K. Norris, Senior Marketing Specialist,
Foreign Agricultural Service

EARLY DEVELOPMENT

Cotton is perhaps indigenous to Northeast Brazil. The earlier settlers found the natives growing and using cotton. In a short time cotton production became a source of revenue on the large plantations, particularly in the region around Bahia, Pernambuco, and Maranhao. Cotton exports as early as 1700 are said to have attracted the attention of the Portuguese King, who sent to Brazil several natives of India that they might teach the spinning and weaving of cotton to the slaves and natives of the colonies.

While cotton was an item of income on many of the early plantations, it did not become of major importance until about 1862, when, due to the Civil War in the United States, American cotton was cut off from European spinners. The planters of the Northeast States responded to the demand of European spinners and increased the crop far beyond the local requirements. Annual exports during and immediately following the American Civil War are said to have reached unusually high levels. Following the close of the War and the return to normal production in the United States, the Brazilian crop declined rapidly and in a short time was again relatively unimportant. The freeing of the slaves, the breakdown of the old Brazilian plantation system, and the rise of the rubber industry in the Amazon Valley contributed to a further decline in cotton production. However, following the decline of the rubber industry, early in the present century, many people returned to the northeastern area and both capital and labor were again employed in cotton production. The development of the domestic textile industry about this time stimulated cotton growing and was responsible in part for the renewed interest. Within the last two decades Brazil has become both a cotton producing and consuming country. Recent shifts, however, in the local textile industry from the Northeast to the South have influenced production and are changing the outlook in Northeast Brazil.

PRODUCTION, ACREAGE, AND YIELDS

Production in the Northeast States until recently has averaged (1924-25 to 1933-34) about 437,700 bales per year or about 75 percent of the total Brazilian crop. The peak production of the Northeast States during the last 20 years was the 1934-35 crop, estimated at 738,000 bales.

^{1/} This report is based upon a field investigation of this area made by the author in 1934. For a report on Cotton Production in Southern Brazil, see F.S. 63, United States Department of Agriculture, Bureau of Agricultural Economics.

This represents an increase of 172,000 bales over the previous record crop of 566,000 bales in 1924-25. Annual production has fluctuated between this peak and the low crop of 226,000 bales in 1932-33. (Table 1.)

The average annual production for the five-year period from 1914-15 to 1918-19 was approximately 312,000 bales or almost 80 percent of the total of the country. During the five years from 1919-20 to 1923-24, the Northeast States harvested about 72 percent of the total Brazilian crop, while during the next two five-year periods this section produced only about 70 percent. Since 1932-33 these states have produced a decreasing percentage of the total Brazilian crop. This decline in the proportion of the crop grown is due to the rapid increases in the Southern States rather than to any reduction in the Northeast States.

Acreage, like production, has fluctuated widely but the average over a period of years has shown very little change. (Table 1) The record acreage was 1,583,000 acres planted in 1931-32, while the low point was 860,900 acres in 1921-22. During the period for which data are available the Northeast States have planted, on an average, about 80 percent of the total Brazilian cotton acreage. However, this region has partially lost its position of dominance as the Southern States of Brazil have expanded their cotton acreage more rapidly. From 1924-25 to 1928-29 the Northeast States planted on an average about 1,071,000 acres, or a little more than 80 percent of the country's total cotton acreage. The 1929-30 acreage was almost 90 percent of the total cotton area of Brazil. During the five-year period ended 1933-34, the average cotton acreage of the Northeast States, although increased to 1,368,000 acres, was only 73 percent of the country's total cotton acreage. Increases in the Southern States have occurred largely during the last three years of this period and account for the recent decline in the proportion of acreage of the Northeast States to the total acreage of the country. A large part of the Northeast acreage is tree cotton that grows for five to fifteen years after planting. For this reason annual acreage changes are not as great as in an area where all is annual cotton.

According to the data available for both acreage and production (1921-22 to 1933-34), the average annual yield of Northeast Brazil is about 178 pounds per acre. This is compared to 183 pounds per acre for the Southern States of Brazil and an average of 181 pounds for the entire country. In the United States the average yield was 168 pounds. While the average yield of Northeast Brazil appears to be in line with average yields in the Southern district, it must be pointed out that this area is subject to wide annual fluctuations. The highest annual yield was 240 pounds per acre reported in 1924-25, while the lowest yield was 92 pounds per acre during the season of 1932-33. (Table 1.) These wide variations are due primarily to the periodical droughts common throughout much of the cotton area of Northeast Brazil.

Table 1 - Cotton Production, Acreage, and Yield, Northeast Brazil,
1922-23 to 1933-34 ^{1/}

Year	Production	Acreage	Yield
	<u>Bales of 478 pounds:</u>	<u>Acres</u>	<u>Pounds per acre</u>
1922-23....	391,031	1,069,417	175
1923-24....	404,092	1,087,929	178
1924-25....	566,484	1,127,502	240
1925-26....	482,751	1,008,538	229
1926-27....	430,689	911,399	226
1927-28....	435,267	1,121,536	186
1928-29....	400,452	1,187,489	161
1929-30....	530,511	1,306,222	194
1930-31....	387,728	1,368,689	135
1931-32....	448,913	1,582,979	136
1932-33....	225,990	1,177,564	92
1933-34....	447,543	1,406,320	152
1934-35....	722,260		

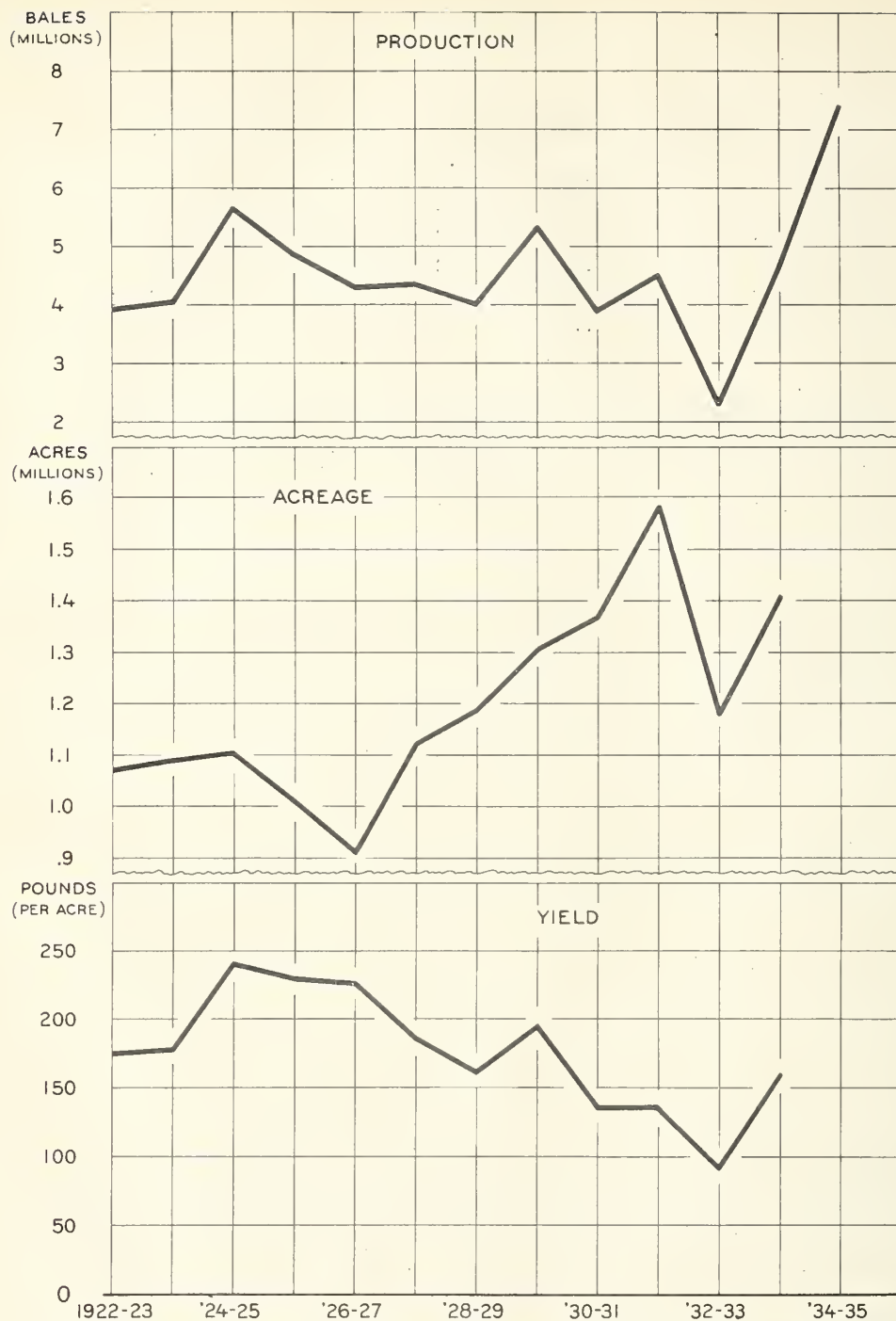
^{1/} Acreage and yield for 1934-35 not available.

Compiled from official estimates of Ministry of Agriculture, Rio de Janeiro, Brazil.

COTTON-GROWING AREA

The area referred to as Northeast Brazil includes the states of Espirito Santo, Bahia, Sergine, Alagoas, Pernambuco, Parahvba, Rio Grande do Norte, Ceara, Piauhv, Maranhao, and Para. These states form the extreme northeastern portion of the Brazilian coast. The states of Espirito Santo and Para are relatively unimportant in cotton production. The total area of the eleven states is estimated at 1,133,253 square miles, or an area four times the size of Texas. Much of this vast region is forest, jungle, desert, and waste land, uninhabited and practically uninhabitable. While the area is enormous, only a small percentage of it can, by the most liberal estimates, be classed as potential cotton land. The task of clearing the land, developing the transportation facilities, preparing the soil, planting and cultivating a crop over this large area is one far beyond the ability of the present generation. The cultivation of any considerable part of this vast area will require labor far in excess of the present supply. (Table 2.)

A liberal estimate of the land under cultivation will not exceed 25 percent of the total area. This includes the land used for grazing purposes as well as that actually under crops. As previously stated, the cotton area at present is equal to about 1,406,320 acres. From the standpoint of available land, cotton could no doubt be extended considerably in the Northeast States, but the extension will depend upon factors other than available land.



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FIGURE 1.- COTTON PRODUCTION, ACREAGE, AND YIELD, NORTH-EAST BRAZIL, 1922-23 TO 1933-34.

THIS SECTION OF BRAZIL WAS, UNTIL VERY RECENTLY, THE CHIEF COTTON GROWING AREA OF THE REPUBLIC.

The cotton-growing area of Northeast Brazil may be divided into three districts. The first is the narrow coastal plain ranging from 10 to 50 miles in width and extending the full length of the coast. Back of the coastal plain is a second district which includes the foothills and a low coastal mountain-range. This district, while not so well watered as the coastal area, produces fair crops during the years of normal rainfall distribution. The third district is a high arid and semi-arid plateau lying back of the coastal mountains. This third district is the northern extremity of the Great Brazilian Plateau which extends into Southern Brazil. The western and southern portions of the states from Ceara to Bahia are within this third district. Much of the plateau is broken by low hills. Because of the light rainfall over most of it, the vegetation is rather scant and the country is open. Much of this area resembles the arid section of the western United States.

While a part of the Northeast States is in the Amazon basin, this area grows very little cotton. In the state of Para cotton is grown to a small extent in the Amazon Valley, but it is of little importance and, until the population increases and the unfavorable natural factors are overcome, will remain relatively unimportant.

Table 2 - Area, Cotton acreage, Population, and Density of population of Northeast Brazil

State	Area	Cotton Acreage : 1933-34	Population : 1930	Density of population
	Square miles	1,000 acres		Persons per square mile
Espirito Santo.....	17,252		744,695	43.17
Bahia.....	204,395	74.1	4,432,379	21.69
Sergipe.....	8,321	123.6	572,922	68.85
Alagoas.....	11,031	164.8	1,266,046	114.77
Pernambuco.....	38,322	165.6	3,146,678	82.11
Parahyba.....	21,591	370.6	1,464,800	67.84
Rio Grande do Norte..	20,236	247.1	818,645	40.45
Ceara.....	57,371	74.1	1,739,062	30.31
Piauihy.....	94,819	42.0	887,055	9.36
Maranhao.....	133,674	82.6	1,242,399	9.29
Para.....	526,241	61.3	1,616,403	3.07
Total.....	1,133,253	1,406.3	17,931,084	15.82

Compiled from official Brazilian sources.

CLIMATE

The climatic conditions of Northeast Brazil are rather unusual, particularly with respect to rainfall. It is the general impression that, because this area is so near the equator, the rains are heavy and that

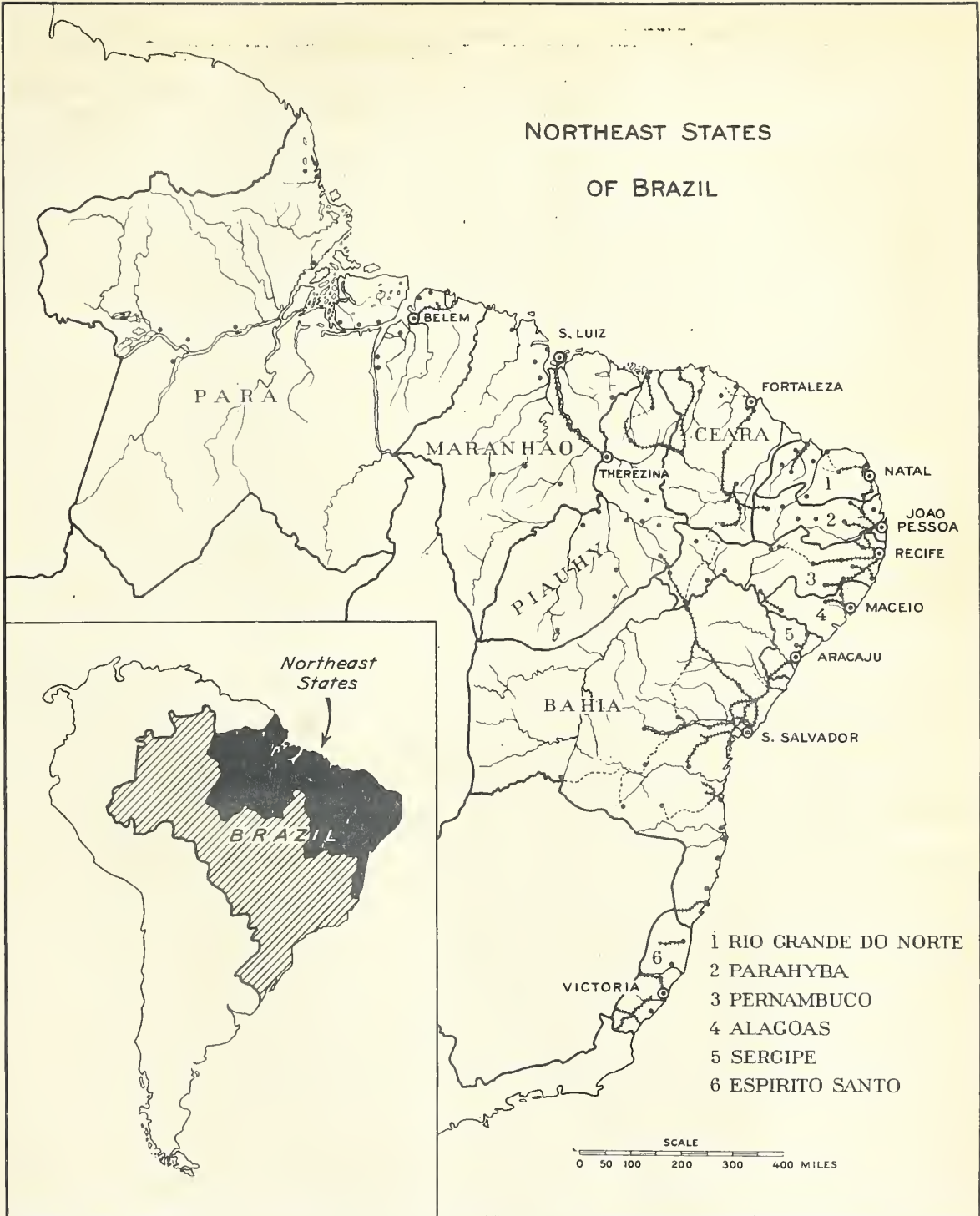
the country is completely covered with heavy forests and jungles. As a matter of fact, there are large areas between Bahia and Ceara that receive very little rain. The native vegetation resembles the desert vegetation of New Mexico and Arizona. Rainfall along the coastal plains may be as much as 60 inches or more annually, while at points in the interior plateau it may be almost nothing. Not only is the rainfall light but the distribution of the rainfall has an important bearing upon the production of crops. The desert area of Northeast Brazil receives most of its meager rainfall from January to June. After June or July, as a rule, very little rain falls in the interior. This area is subject to long periods of extremely dry weather accompanied by intense heat. During these periods the people of the area are forced to move to the coastal plains, returning again as soon as it rains.

This extremely dry weather over a large part of Northeast Brazil is explained by the fact that the trade winds blowing across the Atlantic in a northwesterly direction lose much of their moisture when they strike the coastal mountains before reaching the central plateau. The trade winds from the North and northeast strike the extreme north coast of Brazil and, because there are no mountains in this area, carry the moisture much farther inland. This accounts for the heavy rains of the Amazon Valley and the coast west of Piahy, while the area back of the coastal mountains is a semi-desert.

It appears that the annual rainfall over much of the interior ranges from 35 to as low as 6 inches. Fair crops of cotton in this area are grown with an annual rainfall of as low as 18 inches if properly distributed throughout the growing season. Normally, about 90 percent of the precipitation occurs from January to July with about half of the total in March, April, and May. Very little rain is to be expected from August to November and about 10 percent of the total during December.

In seasons of poor distribution of rainfall the first three months of the year often receive 90 percent or more of the annual total. (See table 3.) This distribution results in a very low yield. Five of the last ten years have been short-crop years due to poor distribution or light rainfall. (See table 4.)

NORTHEAST STATES OF BRAZIL



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FIGURE 2.- THESE ELEVEN STATES FORM THE EXTREME NORTHEAST SECTION OF THE COUNTRY. THEY HAVE A TOTAL AREA OF 1,133,253 SQUARE MILES.

Table 3 - Rainfall: Annual average and monthly distribution in Northeast Brazil

Month	Average Rainfall ^{1/}	Distribution in good seasons ^{2/}	Distribution in poor seasons ^{2/}
	Inches	Inches	Inches
January ^{3/}	3.9	3.5	8.5
February ^{3/}	5.3	4.5	10.5
March ^{3/}	6.4	6.5	12.0
April ^{3/}	5.3	7.5	--
May.....	3.0	4.5	--
June.....	2.0	2.5	2.5
July.....	1.1	1.5	--
August.....	.8	--	--
September.....	.4	--	--
October.....	1.0	--	--
November.....	1.9	--	--
December.....	2.4	3.0	--
Total.....	33.5	33.5	33.5

^{1/} Ten stations in the cotton-growing area of the Northeast.

^{2/} Based on private reports and records of cotton planters in the interior of the state of Rio Grande do Norte, obtained by the author.

^{3/} Months in which cotton is planted.

Table 4 - Rainfall: Annual variations at selected points in the interior of Northeast Brazil ^{1/}

Year	Inches of Rainfall
1925.....	25.8
1926.....	22.6
1927.....	17.6
1928.....	11.7
1929.....	19.0
1930.....	9.5
1931.....	8.9
1932.....	5.9
1933.....	11.1
1934.....	21.8
Average.....	15.4

^{1/} From private reports and records of cotton planters.

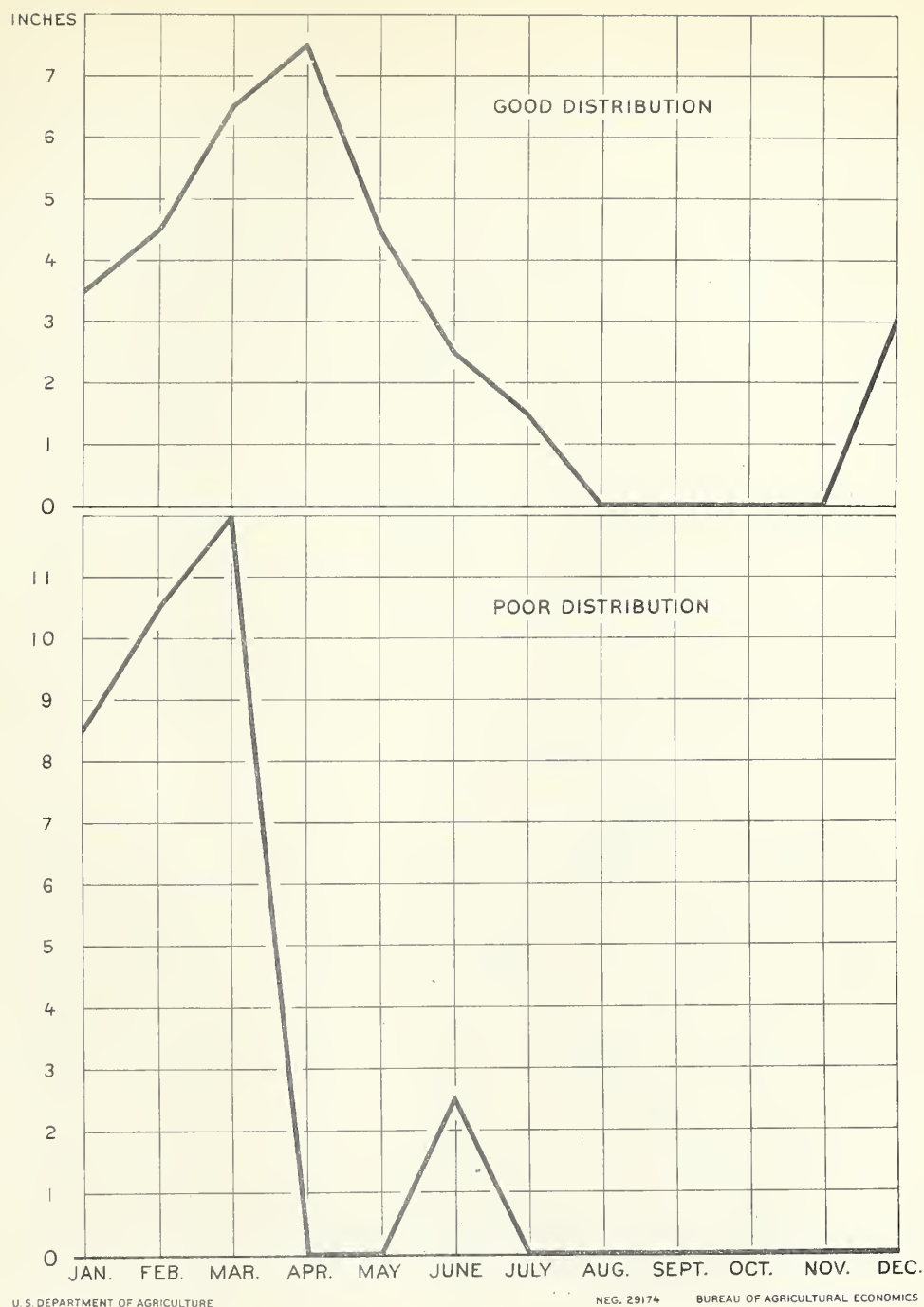
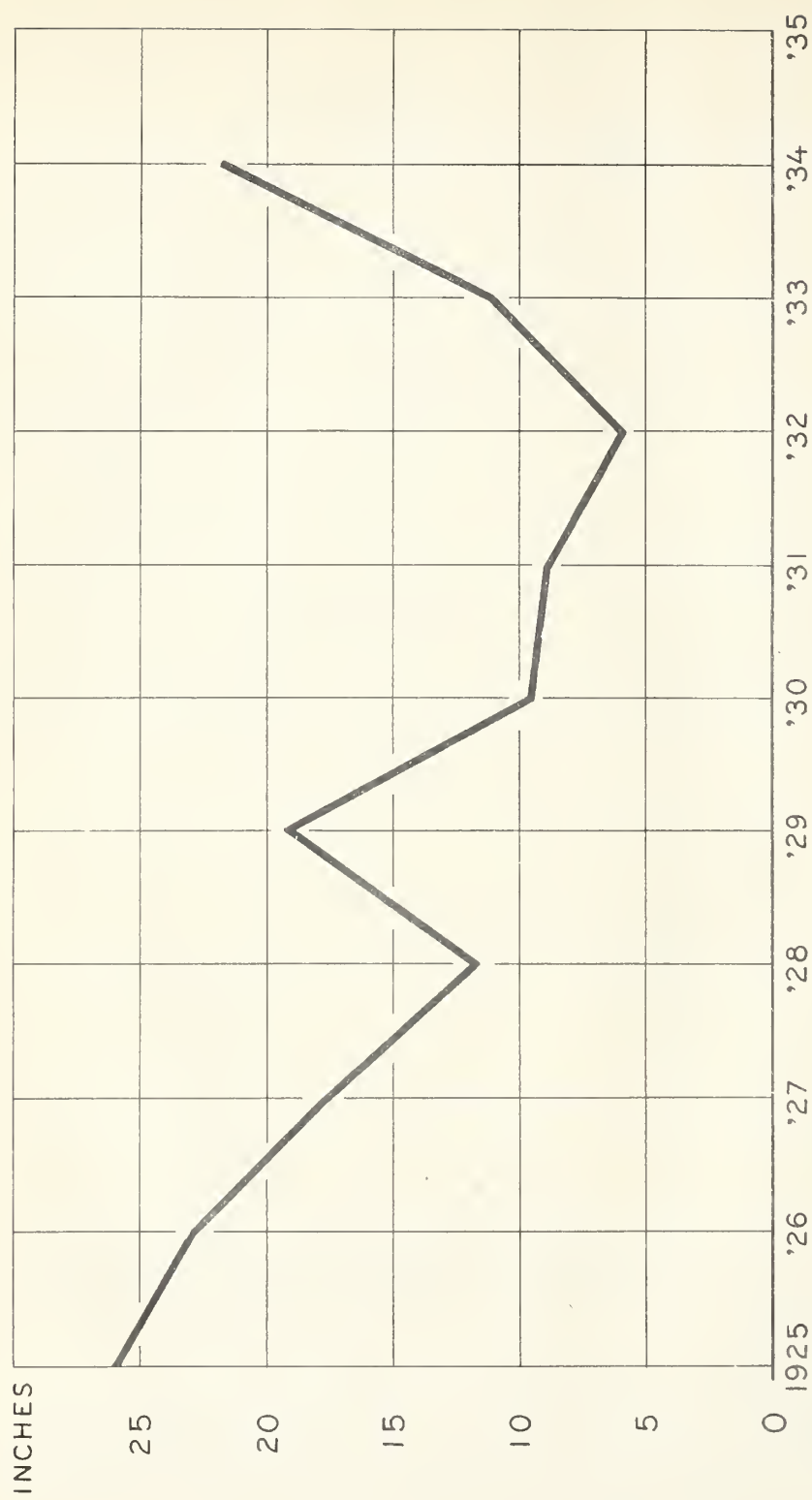


FIGURE 3.- MONTHLY DISTRIBUTION OF RAINFALL.

THE MONTHLY DISTRIBUTION AS WELL AS THE ANNUAL TOTAL IS OF GREAT IMPORTANCE TO THE INTERIOR OF NORTHEAST BRAZIL. WITH AN ANNUAL RAINFALL OF 18 TO 40 INCHES AND GOOD DISTRIBUTION FROM PLANTING TIME TO JULY, GROWERS MAY EXPECT A FAIR CROP. THIS ANNUAL RAINFALL WITH POOR MONTHLY DISTRIBUTION, HOWEVER, WOULD RESULT IN A VERY SHORT CROP.



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FIGURE 4.- ANNUAL RAINFALL AT SELECTED POINTS IN THE INTERIOR COTTON DISTRICT OF NORTHEAST BRAZIL.

THE ANNUAL FLUCTUATIONS IN PRODUCTION (TABLE 1) FOLLOW IN GENERAL THE VARIATIONS IN THE ANNUAL RAINFALL. THE YEAR 1932 WAS ONE OF LIGHT RAINS AND POOR DISTRIBUTION, RESULTING IN THE SHORT CROP OF 1932-33; WHILE IN 1933 AND 1934 RAINS WERE HEAVIER WITH NOTABLE INCREASE IN THE 1933-34 AND 1934-35 CROPS.

Temperatures are exceedingly high throughout Northeast Brazil, and for that reason rainfall is less effective than in areas of low temperature. Along the eastern coast high temperatures are accompanied by high humidity and, were it not for the trade winds, it would be very unpleasant. During the rainy season the interior plateau is comparatively cool but during the dry seasons the temperatures are extremely high. (Table 5.)

Table 5.- Temperatures: Normal annual, maximum, and minimum, at selected stations in the cotton-growing area of Northeast Brazil

Station Location	Average Annual	Average Maximum	Average Minimum
	°F.	°F.	°F.
Para.....	78.4	87.4	71.8
Maranhao.....	79.7	85.6	74.8
Ceara.....	81.1	89.8	75.0
Rio Grande do Norte....	78.8	87.8	66.4
Parahyba.....	77.4	85.3	70.0
Pernambuco.....	70.9	81.7	63.1

Compiled from official Brazilian sources.

SOIL

The soil of Northeast Brazil ranges from a light sand to a heavy clay. Over much of the dry plateau of the interior a coarse sandy or gravelly soil is common. The coastal plain soils are largely sandy loams and clay soils. The interior plateau soils, with the exception of the gravelly soils, are relatively fertile and when watered produce good crops. The soils of most of the river valleys are of alluvial formation. The soils of the coastal plain, in spite of the fact that this is the oldest farming area of Brazil, are the most productive. This is due, however, more to rainfall than to soil fertility.

In parts of the interior plateau the rock is so near the surface that the cultivation of crops is impracticable. Much of this area produces very little grass and is of little value as grazing land. Where the soil is fertile and the rains more regular, the area supports large herds of cattle, sheep, and goats. The better soils of the interior are found along the rivers and creeks. These soils range from a sandy loam to a heavy clay loam, and on this type of soil the bulk of the tree cotton of Northeast Brazil is grown.

COMPETITIVE ENTERPRISES

Over most of Northeast Brazil the competition between cotton and other crops is for labor rather than land. If cotton were not grown, no cash crop would be produced.

When the rubber industry of the Amazon Valley began to decline, hundreds of people left the rubber districts and settled in Northeast Brazil. These people took up the production of cotton as a cash crop and its development has been largely due to their efforts. Livestock raising is an important occupation of the interior. This interior country produces large numbers of cattle, sheep, and goats. Along the coastal plain, where the population is more dense, such crops as sugar, tobacco, and citrus fruits are grown. The state of Bahia produces the bulk of the Brazilian tobacco crop, while Pernambuco, Alagoas, and some of the other Northeast States produce large quantities of sugar. In addition to tobacco, the state of Bahia produces most of the cocoa crop. In Ceara and the states west of Ceara the production of Carnauba wax is an important industry. This wax is gathered from a palm tree which is grown wild and requires little or no cultivation. This area also yields large quantities of Brazil nuts and other semi-wild crops. Coffee is grown in every state of Northeast Brazil but the total is equal to only about ten to fifteen percent of the total Brazilian production. Espirito Santo is perhaps the leading coffee-growing state of this area.

LABOR SUPPLY

The population of Northeast Brazil is estimated at 17,931,084. The heaviest populated area is the coastal plain, where in some sections the population is very dense. Estimates indicate that the heaviest populated rural section of Brazil is the coastal plain between Pernambuco and Natal. The people of this section, while engaged in agriculture, are also engaged as laborers in the cotton spinning mills. They produce a part of their own food but to a large extent depend upon their labor in the mills for their cash income. Because of the decline in the price of sugar, several of the larger sugar plantations along the coast find it impossible to maintain past wage levels. And as a result, a number of laborers are now leaving the sugar plantation and taking up cotton production. In other sections of the coast the growing of sugar on the larger plantations is being replaced to some extent by cotton.

The population of the interior is rather scant. There are few cities of any importance. The people find a peculiar fascination in this semi-desert region and even though they are sometimes forced by long dry periods and crop failure to migrate to the coast, they return as soon as rains have fallen. These people produce their own food in addition to cotton. Permanent agriculture, however, is rather difficult under conditions prevailing over most of the interior and, were it not for the perennial type of cotton grown, it is possible that this district would be of very little value other than for grazing.

The people are of Portuguese and native Indian stock, while along the coast, particularly in the state of Bahia, the descendants of the early slaves are common. As a rule, the people of Northeast Brazil may be said to be a mixture of the three races, the white, the negro, and the Indian. While the climate is, on the whole, not conducive to work, the average native makes little effort to overcome this natural handicap. The average agricultural laborer is inclined to exert little more than the effort required to meet his limited wants.

PRODUCTIVE CREDIT

The production of perennial cotton requires very little capital. The average farmer has only a few acres, usually planted on the lowlands, along the creek valleys. Because this cotton stands from 5 to 15 years, it is not necessary to replant each season. About the only expense required to produce it is labor. Once it is established, it requires very little cultivation.

In sections of the Northeast the cotton ginner or buyer makes small advances to growers. In recent years, with the export demand increasing, this practice has become more common but as a rule there is but little organized effort to supply credit to growers. Most growers have very little to offer in the way of security for such loans.

THE QUALITY OF THE CROP

The cotton of Northeast Brazil is of two types: the perennial or tree cotton, and the upland. Much of the tree cotton, however, is badly mixed with the annual varieties. Originally the tree cotton was of an exceptionally long staple, often averaging as much as 1-1/4 inches in length. Where this cotton is free from mixture, the staple is about 7/8 to 1-1/4 inches in length. (See table 6.)

The annual cottons, originally from American upland seed, are grown along the coast and are always referred to as "Matta" cotton to distinguish them from the tree cottons. In the area between the coast and the interior plateau, especially in the regions of the heavier rainfall, some annual cotton is grown, but the tree cotton is the predominating variety. It is in the area in which both the upland and the tree cottons are grown that the greatest mixtures occur. Few Brazilian farmers realize the importance of pure varieties and often plant the annual cotton in fields of tree cotton. This not only produces a crop of mixed staple but also results in the deterioration of both varieties by crossing. In many parts of Northeast Brazil the once well-known varieties of tree cotton have been practically eliminated by this method of mixture and crossing. The cotton grown along the coast usually averages about 7/8 to one inch in staple. Much of this cotton was originally used by local mills, leaving the tree cotton for export. In recent years, however, a part of the upland crop, as well as the tree cotton varieties, has been exported.

Table 6 - Cotton: Estimated production by states and staple length, Northeast Brazil, 1932-33

States	:Less :7/8 :1-1/8 :			:Less :7/8 :1-1/8 :			Total	
	:than :to :inches:			:than :to :inches:				
	:7/8 :1-3/32:and :			:7/8 :1-3/32:and :				
	:inch :inches:longer:			:inch :inches:longer:				
	:1,000:	1,000 :	1,000:	1,000:	Per-:	Per-:	Per-:	Per-
	:bales:	bales :	bales:	bales:	cent:	cent:	cent:	cent:
Para.....	--:	8.1:	.2:	8.3:	--:	97.1:	2.9:	100.0
Maranhao.....	1.5:	19.9:	14.0:	35.4:	4.2:	56.3:	39.5:	100.0
Piauihy.....	.1:	6.7:	.3:	7.1:	1.1:	95.1:	3.8:	100.0
Ceara.....	.3:	5.2:	8.3:	13.8:	2.5:	37.4:	60.1:	100.0
Rio Grande do Norte...	.3:	3.0:	22.1:	25.4:	1.4:	11.7:	86.9:	100.0
Parahyba.....	3.2:	18.8:	19.5:	41.5:	7.7:	45.4:	46.9:	100.0
Pernambuco.....	.3:	31.1:	10.1:	41.5:	.8:	74.6:	24.4:	100.0
Alagoas.....	.3:	28.3:	--:	28.6:	.9:	99.1:	--:	100.0
Sergipe.....	1.2:	7.1:	--:	8.3:	14.3:	85.7:	--:	100.0
Bahia.....	1.3:	14.8:	--:	16.1:	8.2:	91.8:	--:	100.0
Total.....	8.5:	143.0:	74.5:	226.0:	3.8:	63.2:	33.0:	100.0

Bureau of Agricultural Economics. Based on an official compilation of staple lengths for the Brazilian crop, published in "Economic Aspects of Brazilian Cultivation" by J. M. LeLyra, 1933. Publication #4 of the Director of Public Statistics, Rio de Janeiro. Millimeter lengths were converted to inches on the assumption that 25 mm. and less equals 7/8-inch and shorter; 23 to 29 mm. equals 7/8-inch to 1-3/32 inches; and 30mm. and longer equals 1-1/8 inches and longer. These conversions are made with the knowledge that differences in classing and in the collection of this information may affect the comparability of these lengths with similar lengths of American cotton classed on Official Standards, but a comparison of staple length designations for actual samples received from Brazil and classed by qualified government classers in the United States indicates that these conversions are approximately accurate.

The grade of Brazilian cotton is low, due largely to the method of picking and handling. In addition to being poorly picked, it is usually ginned in a plant where no cleaning machinery is used. The cotton gins of Northeast Brazil are generally small, old, and in poor repair. The plants consist in the main of one-stand gins, usually of about 50 saws. Most gins, however, are equipped with a small press where the lint is pressed into bales weighting about 200 pounds.

The cotton ginner is usually the primary buyer, buying in the seed and ginning all cotton together irrespective of quality. After the cotton has been ginned, it is usually sold to larger merchants who send it to the coast. At the seaport the country bales are broken and repressed into uniform high density bales. Because so much of the Northeast cotton is badly mixed, an effort is often made at the time the cotton is compressed to separate the broken bales into the two types of cotton. The method used is based upon the theory that a trained man can detect a slight color difference between the two types. The open bale is spread out and the men separate the lint. This method, of course, is very crude and is only

approximate, but it eliminates a great deal of the mixtures and is said to improve its value. It is not uncommon, however, for European spinners to report as much as 30 percent waste in some Northeast Brazilian cotton. This lack of uniformity has been a factor in the increased use of Southern Brazilian cotton over Northeast cottons by the Southern textile industry.

HANDLING AND MARKETING METHODS

The cotton ginnerers buy from the growers. In most cases, they are small operators who are unable to finance large deals and are, therefore, often associated with exporters and larger merchants. In a few places the exporters are becoming interested in the construction of modern, up-to-date ginning plants and are buying direct from the growers. The production of cotton along the coast requires more capital, but in most cases it is readily obtainable. In the interior the lack of production credit is no doubt a limiting factor in cotton production. Many farmers of this area would grow cotton if credit were available.

Most of the Northeast Brazilian cotton is sold under a local trade name, which is usually the variety name or the name of the district in which it is grown. Such cottons as "Moco," "Serido," and "Matta" are examples of local terms. "Moco" is a variety name, while "Serido" refers to the district from which the cotton comes. Both are tree cottons. "Matta" is a name applied to the upland cotton grown along the coast.

The Brazilian Government, through its Ministry of Agriculture, has established nine grades for each of the various types of cotton grown within the country. Of these, physical standards for five grades have been promulgated and four are descriptive. While these grades are not exactly comparable to American standards, it is generally recognized that No. 5 of the Brazilian standard corresponds roughly to No. 7 of the American standard; that is, Brazilian middling is usually of the same grade as American low middling. The staple length of Brazilian cotton is expressed in millimeters.

TRANSPORTATION

Transportation facilities of the Northeast States are, on the whole, poor. The few miles of railroads in this area extend back but a short distance from the seacoast towns. In addition to being inadequate, the railroad equipment is in a dilapidated condition. There are but a few lines of standard gauge road in the entire area. The road beds are poor and unkept and the service slow and expensive.

During the wet season a few of the rivers are open to small boats. The extremely low rainfall prevailing in the interior makes it impossible to use river transportation throughout the year. Coastwise boat service is maintained between the northern ports.

Highways are few and usually unimproved. With two or three exceptions, there are no paved highways in Northeast Brazil. During wet seasons, the highways are practically impassable, but during dry seasons they are in constant use. Motor truck and bus transportation is becoming more common.

Transportation is one of the major problems in the development of Northeast Brazil. Many farmers of the interior are still dependent upon the primitive ox cart or mule pack train for the transportation of their crops to market. In recent years, as a drought relief measure, the Government has built something like 4,000 miles of dirt highways in the Northeast States, but when the size of this area is considered, it is obvious that there are still large sections long distances from highways and railroads. In much of the area the people are still dependent upon the slow native ox cart.

CONSUMPTION AND EXPORTS

The oldest spinning and weaving establishments of Brazil are located in Northeast Brazil. At present about 72 cotton mills operate 555,991 spindles and employ approximately 39,658 people in this section of the country. These plants are located along the coast, principally in the states of Pernambuco, Alagoas, Sergipe, and Ceara. In recent years, however, the output of the Southern Brazilian mills has surpassed that of the mills of the Northeast. The total cotton consumption of Brazil during the last three years for which data are available (1930 to 1932) averages about 420,000 bales per year, of which approximately 120,000 bales were consumed in the Northeast States.

Exports from Northeast Brazil, with the exception of 1929 and 1930, have not exceeded 100,000 bales in any year during the decade ended 1933. (Table 7.) While no data for 1934 are available, it is estimated that 1934 exports were at least equal to, if not in excess of, the previous record of 200,000 bales in 1929. The textile industry of Southern Brazil for several years used large amounts of Northeast cotton, but with the recent improvement of quality of the Southern crop, these mills are likely to take less Northeast cotton. A large percentage of the Northeast crop may, therefore, be exported. The present exports are largely to Great Britain and the continent of Europe.

Table 7 - Cotton: Exports and consumption, Northeast Brazil,
1923 to 1933

Calendar year	Exports	Consumption
	Bales of 478 pounds	Bales of 478 pounds
1923.....	63,051	
1924.....	25,592	
1925.....	94,985	
1926.....	74,720	
1927.....	49,976	
1928.....	46,133	
1929.....	207,353	
1930.....	139,983	108,583
1931.....	95,377	125,725
1932.....	2,376	117,608
1933.....	45,087	

Compiled from official Brazilian sources.

COTTON PESTS

With the exception of the Mexican boll weevil, Northeast Brazil has about all the common cotton insects. So far as is known, the Mexican boll weevil has not invaded the Brazilian cotton belt, although the pink boll worm, the boll worm, and several other destructive insects are widespread. Over large areas of the interior plateau, grasshoppers are also a menace to crops. Cotton and other crops are often damaged or completely destroyed by grasshoppers.

While no reliable data as to insect pests are available, it is recognized that pink boll worm is one of the most destructive cotton insects of the country. The treatment of the planting seed with chemicals or the exposing of the seed to the direct rays of the tropical sun for several hours is a common practice for the control of pink boll worm. When properly carried out, either of these treatments gives a fair degree of protection, but often, due to the manner in which the treatment is performed, it is practically worthless.

The common boll worm does a great deal of damage in the humid coastal plain area. The damage in this area is high, especially if the fall rains are heavy. As a rule, however, the boll worm does little damage in the dry interior plateau.

The semi-arid interior plateau affords an ideal breeding ground for grasshoppers. While the damage may not be widespread, these insects are present somewhere in the interior every season and are very destructive in such areas.

The most common cotton plant diseases are also present in the Northeast cotton belt. While sometimes serious, they are as a rule not as destructive or as widespread as the insect pests.

The absence of frost and freezing weather, the continuous growth of the cotton plant, especially the tree cotton, create a condition favorable for all kinds of cotton insects and diseases. These conditions also render control measures extremely difficult once the pest becomes established. The damage from insects and disease may be expected to increase as the area of cotton is increased.

GOVERNMENT AID TO COTTON PRODUCTION

Considerable effort on the part of the Government to promote construction of irrigation projects in Northeast Brazil has been made. While some 15 or 20 Government projects have been outlined, only three or four have been undertaken, and the area served by those is relatively small. Should the Government complete its irrigation projects, particularly those in the states of Ceara and Rio Grande do Norte, this section of Brazil will become more productive both from the standpoint of food crops and cotton. The possibility for expansion and completion of these Government projects, while not assured, is brighter at the present time than for several years past.

As temporary relief measures, the Government has spent large sums of money in the constructions of highways and small reservoirs in the interior. During the periods of extreme drought, it is often necessary to extend relief to large numbers of people. It is estimated that at one time a million people were dependent upon this type of relief. However, as long as the Government depends upon this relief labor for the completion of its irrigation projects, real progress will be slow. The expenditure of large sums as temporary or emergency relief measures has been of little value in the completion of the irrigation program.

The most important influence this type of relief has had on cotton production is that it has enabled hundreds of farmers to remain in the area during the drought. As soon as rains come, the relief work is discontinued and they return to their farms.

The Federal Government has in recent years taken a special interest in the production of cotton in Northeast Brazil. The principal cotton experimental station and laboratory of the Federal Government has been transferred to this section. A number of State and Federal experiment stations have been opened and the distribution of pure seed has received increasing attention. The decrees regulating the distribution of seed, the treatment of seed for the eradication of the pink boll worm, the inspection and licensing of cotton gins, and the classification of all cotton exported have had an influence on increasing the quantity and improving the quality of Northeast Brazilian cotton. In addition to this direct influence and assistance, the Federal Government has, through its tariff policy, practically prohibited the importation of foreign cotton, thus requiring mills to use locally grown cotton.

Cotton merchants of Northeast Brazil have for several years realized the importance of cotton as a cash crop and are now making a special effort to stimulate production and expand exports. Local newspapers, Chambers of Commerce, and other business organizations are engaged in a campaign designed to stimulate the interest of farmers in cotton growing.

Another factor that has stimulated exports in the past is the policy of the Government with respect to the control of foreign exchange. During the first eight or nine months of 1934 the Government required cotton exporters to sell only about 30 percent of their foreign exchange at the official rate, which was lower than the open market rate. Exporters of other commodities, particularly coffee, were required to sell 100 percent of their foreign exchange at the official rate. This measure favored the cotton export trade and was a substantial aid in the movement of the unusually large crop of 1933-34. In fact, it allowed an exporter of cotton, by selling a large part of his exchange on the open market, an exchange profit of approximately 10 to 15 percent on his total shipment. In recent months, however, the exchange situation has changed and at present is not as favorable to cotton exports as in the past.

OUTLOOK FOR COTTON PRODUCTION IN NORTHEAST BRAZIL

Production in this section of Brazil has fluctuated widely in past years. In the interior, good yields are obtained during seasons of favorable rain, but in years of short rainfall very little cotton is harvested. Plantings of new areas are made in years of good rains and, as the plants often stand for several years, the total acreage harvested in any year is the result of an accumulation of several years of planting. Expansion in this area, therefore, depends upon the rainfall and the labor supply. Much of the interior is so sparsely settled that it is not likely to expand acreage rapidly. Inadequate transportation places rather severe limitations upon expansion. Areas that might produce cotton if transportation were available are now only accessible by primitive ox cart and mule pack trains.

The possibility of irrigation developing to the point where it will be an important stimulus to production in the interior depends to a large degree upon the governmental policy but is rather remote.

The expansion of cotton acreage in the district between the coastal plain and the interior plateau where the rainfall is heavier and the distribution more uniform depends to a large extent upon the labor supply and the general attitude of the people. Much of this area is far from central markets and handicapped by poor transportation. There is land that could be used for cotton production, but even though the rainfall is more certain than in the interior, the number of people available for the production of cotton is limited. Rainfall, though greater than in the interior, is an important factor in this area.

The district along the coast, where the rainfall is heavy and where the most densely populated areas of rural Brazil are located, appears to offer possibility for expansion. The population of this section is

sufficient to provide labor for cotton growing, but many of the people are engaged in the production of such crops as sugar, tobacco, and food crops. Others are also occupied in industrial work, particularly in cotton textile mills. While the competition of crops such as sugar is not of major importance, it has an influence on the expansion of cotton acreage. The prices received for sugar and other crops have, in the past few years, been so low that several of the larger planters who once produced sugar in this area are now using their labor and land for the production of cotton. Should this continue, it is likely that cotton acreage along the coast would increase.

The possibility of expanding cotton production in the area of the Amazon Valley is rather remote. At the present time there is a small amount of cotton grown in the state of Para, which is, in fact, in the Amazon Valley. Cotton is grown at a few points as far as 500 miles up the river, but these areas are small. The rainfall is heavy and vegetation grows so rapidly that it requires constant cultivation to keep cotton fields free of weeds and grass. This naturally requires a great deal of labor, and the people of this area are, as a rule, inclined to avoid labor as far as possible. They have lived for generations with little effort and consequently feel very little desire to undertake the production of a crop involving as much labor as cotton. Under these conditions the expansion of cotton in the Amazon Valley will be very slow. It is very doubtful that this section will become important at any time in the immediate future.

The history of cotton production of Northeast Brazil is marked by periods in which production reached unusually high levels, only to decline, in some cases to an almost negligible point. The wide fluctuations of the past are explained by such event as the American Civil War, the freeing of the Brazilian slaves, the decline of the Amazon Valley rubber industry, and the rise of the local textile industry. While these as well as other social and economic factors influenced production, it is noticeable that, in most cases, the decline following a period of high production did not reach the previous low level. Over the period for which data are available, the trend of production has been upward.

The rapid increase of the last two years mark the beginning of a period in which production has again reached a high level. In this instance the increase is due largely to favorable weather conditions of the past seasons. While the present crop may not represent the peak of the present increase, it appears reasonable in view of the problems and limitations of this area that any further increases in the annual crop will be at a retarded rate. In the light of past trends it is likely in the course of the next five or ten years production will drop off considerably from the present peak.

Cotton is an old and well established crop of Northeast Brazil. The Northeast States until recently have produced about 437,700 bales annually, or about 75 percent of the total Brazilian crop. In recent years production has increased until the 1934-35 crop is estimated at 722,260 bales. However, the percentage of the total Brazilian crop has declined due to the rapid increase in the Southern States of Brazil. Acreage, like production, has fluctuated widely. Yields average about 178 pounds per acre but have fluctuated between 240 pounds and 92 pounds per acre in past years.

The total area of the states referred to as Northeast Brazil is estimated at about 1,133,263 square miles. While this is an area about four times as large as Texas, only a small percentage of the total can be classed as potential cotton land. Much of it is in forest, jungle, desert, and waste land, uninhabited and practically uninhabitable. The chief districts of production are (1) the coastal plain, (2) the low foothills and coastal mountains, and (3) the interior plateau or plain lying beyond the coastal mountains. The coastal plain is a well watered area producing a variety of tropical and semi-tropical crops, while the foothill district and the interior plateau are semi-desert areas.

American upland cotton is grown in the coastal plain region and to some extent in the foothill district, while the interior plateau produces the famous Brazilian tree cotton. Due to careless methods of handling and marketing, many of the varieties of the tree cottons are badly mixed and the staple is noticeably lacking in uniformity.

In the coastal plain district cotton production is chiefly limited by the competition of other enterprises for the available labor supply. While this section is one of the most densely populated areas of Brazil, many of the people are employed in industry and live in cities and towns. Much of the agricultural labor is engaged in the production of such crops as sugar, tobacco, cocoa, coffee, and food crops. In recent years these crops have not been as profitable as heretofore and some of the large planters, particularly sugar planters, have turned to cotton as a cash crop. There are large sections in the coastal plain area where the soil and climatic conditions are favorable for cotton.

In the foothill district, between the coastal plain and the interior plateau, much of the soil is suitable for cotton, but the climatic conditions are often unfavorable, insect damage high, and yields uncertain.

In the interior plateau the amount of rain and its distribution during the season are the principal factors determining the production of cotton. In years of normal rainfall and distribution this area produces large crops, but during seasons of light rainfall or poor distribution yields are reduced and production may be very small. Two or three years of extreme drought occurring, as they often do in succession materially reduce the cotton acreage in the interior. The poor and inadequate transportation facilities, the scant population, and the lack of production credit influence the cotton production of the interior plateau district of Northeast Brazil.

The history of cotton production in Northeast Brazil is marked by wide fluctuations. The decline following periods of high production has not as a rule reached the previous low level and the trend has been upward. The present high production, due largely to favorable weather, may not represent the peak of the upward trend; but in view of the many limitations and production problems of this section, it is reasonable to expect that any further expansion will be at a retarded rate, and that within the next few years production will drop off from the present peak.

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